REMARKS

The Examiner is thanked for the recent Office action, and for the allowance of claims 1-13. Claims 15 and 19 are hereby amended as Examiner suggested, to incorporate the limitations of their respective independent claims, and are now believed to be in condition for allowance. Claim 16 is cancelled.

Applicant respectfully submits the following remarks in favor of allowance of claims 14 and 17-18, which currently stand rejected. These rejections are hereby traversed. Favorable reconsideration is respectfully requested.

I. Rejection of claims 14 and 17 under 35 USC 102(b)

Claims 14 and 17 are rejected as anticipated by Evans, USPN 4346591. In rejecting the claims, Examiner states:

> Evans discloses a method of operating a drill rig comprising using downhole circuitry to signal a change in downhole sensors by causing a reduction in drilling fluid long time average pressure (see col. 1, lines 48-55).

Examiner uses this passage to reject, for example, claim 14, which states:

> 14. A method of operating a drill rig, comprising the step of:
> using downhole circuitry to signal a change in downhole equipment condition by causing a reduction in drilling fluid long-time average pressure.

Applicant respectfully submits that Examiner's cited passage from Evans does not show all limitations of claim 14, arranged as they are in claim 14. A prior art reference anticipates the claimed invention under 35 U.S.C. § 102 only if every element of a claimed invention is identically shown in that single reference, arranged as they are in the claims. *In re Bond*, 910 F.2d 831, 832, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990).

Applicant respectfully submits that the passage of Evans cited by Examiner must be viewed in the context of a loss of fluid or lubricant, due to a failed bearing seal, for example. Evans states at col. 1, lines 34-39:

> Previous devices which sense the condition of the antifriction bearings are those which respond to heat and to the condition of the various wear and bearing surfaces, and which are triggered by the release of excessive amounts of bearing lubricant.

Thus, Applicant reads the passage cited by Examiner:

> Many of the sensors devices are connected to devices which modify the pressure in the column of drilling fluid supplied through the center drilling fluid passageway in the drill string, either by increasing or decreasing the pressure in the drilling fluid,

as teaching that the sensors are connected to such devices as the aforementioned bearings, and are enabled to detect the modification of drilling fluid pressure when such devices fail (resulting in a decrease of pressure) or become clogged or blocked (resulting in an increase of pressure). Hence, Applicant respectfully submits that the sensors described in Evans detect changes in pressure, and then signal that information to the surface. Applicant does not read the cited passage to mean that the sensors cause the change in

"long-term average pressure" as claimed by somehow modifying, for example, a bearing seal.

The signaling means of Evans is described in Figure 1, mud pulse telemetry transmitter 46. The change in pressure are described at col. 4, lines 52-61:

> The transmitter means 46 preferably takes the form of a conventional mud pulse telemetry transmitter known in the art and useful for delivering detectable pulsed pressure variations in the column of drilling fluid in the center drilling fluid passageway of the drilling string. The pressure pulse variations are detected by a mud pulse telemetry receiver 47 at the drilling rig at the surface of the earth and are decoded to provide intelligence of the type and significant of signal transmitted.

Applicant respectfully submits that the teaching of "detectable pulsed pressure variations" does not anticipate "reduction in drilling fluid long-time average pressure," as claimed in claim 14. Specifically, this distinction is described in the present application at the description of Figure 49, beginning at the bottom of page 41, which states:

> The signaling idea just described can be extended to binary data transmission. In this embodiment the sleeve valve is used to "transmit" binary encoded data by alternately shifting between open and closed valve positions thereby causing corresponding low and high surface flowing pressures which can be observed at the surface. The type of information to be transmitted could be of any type. For instance, bit condition ratings, pressures, temperatures, vibration information, strain information, formation characteristics, stick-slip indications, bending, torque and bottom hole weight-on-bit, etc, could be transmitted. **Figure** 49 illustrates this transmission scheme. <u>This type of transmission is different that standard mud-pulse technology which is used in MWD systems. The difference lies in the fact that static pump pressure levels are</u>

> monitored rather than transient acoustic pressure pulses. This type of transmission will be much slower than mud-pulse telemetry systems, but is suitable for low tech, low cost settings where complex and expensive surface receivers are not economically practical. Of course, the detection schemes described herein are suitable for integration into a full-blown MWD system as well.
>
> [Emphasis added.]

Hence, the teaching of Evans specifically describes the pulsed, transient signaling mentioned and distinguished in the present application from the claimed variations in long-term average pressure that would be detected from longer duration changes in fluid pressure as claimed in claim 14. It is respectfully submitted that pulses are by definition short term, and a pulse would not significantly modify the long-term average pressure, as claimed in claim 14.

Anticipation focuses on whether a claim reads on the product or process a prior art reference discloses, not on what the reference broadly teaches. *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 218 U.S.P.Q. 781 (Fed. Cir. 1983). [Emphasis added.] For these reasons, Applicant respectfully submits that at least claim 14 is distinguished from the cited reference. Favorable reconsideration is respectfully requested.

Because of its dependence on claim 14, claim 17 is also thereby distinguished from the cited reference. Favorable reconsideration is respectfully requested.

II. Rejection of claim 18 under 35 USC 103(a)

Examiner rejects claim 18 as unpatentable over Evans in view of Randall ('037). Examiner states in part:

> Evans discloses the method of claim 14 but does not disclose that an adaptive filter analyzes the data from the sensor. Randall teaches that adaptive filter improves the quality of the data from a sensor by reducing noise (see col. 4, line 60-col. 5, line 4). As it would be advantageous to improve the quality of the data from the sensor and to reduce any noise, it would be obvious to modify Evans in view of Randall.

Applicant respectfully submits that filtering noise does not teach or suggest the claimed limitation of, "an adaptive filter which analyzes data from sensors," as claimed. Claim 18 is reproduced for reference.

> 18. The method of claim 14, wherein said change in downhole equipment condition is determined by an adaptive filter which analyzes data from sensors located on the drill string.

The passage from Randall cited by Examiner states,

> As previously mentioned, the quality of the data changes due to variations in drilling rate in depth transformed spacings. The quality of the data is not generally obvious from the log of the processed parameters of interest. To enhance the value of the log, the quality indicators (a) precision (repeatability) (b) depth or axial resolution of the measurements and (c) the signal noise are tracked. In addition, this information can be used to control an adaptive filter, with filter characteristics governed by some criteria of data quality. Such an adaptive filter may be used to partially deconvolve sensor response, or to reduce noise to some predetermined level.

Noise filtering, as taught in Randall, by an adaptive filter does not teach or suggest the claimed limitation of analyzing data. The adaptive filter of the present innovations is, in one embodiment, a neural network that predicts future failures of a drill bit based on current readings from a sensor. For example, page 34 of the present application states:

> The adaptive filter (preferably a neural network) attempts to predict sensor readings one step ahead in time using older sensor readings (step 3204). The resulting prediction error statistics are analyzed by the failure detection algorithm for failure (step 3206), and if a failure is detected, the telemetry system sends a warning signal to the surface....

Another section, beginning at the top of page 35, also describes the analysis performed and claimed in claim 18:

> If an adaptive filter prediction is performed on a time-series of vibration measurements taken near the bit, there will be a level of prediction error, which does not change rapidly over a short period of time. This is because the filter will be capable of predicting much of the periodic vibration associated with the bit. However, random vibrations due to the drilling environment such as rock type, fluid noise, etc. will not be predictable and will result in prediction errors. Test data has shown that when a bearing in a cone starts to fail, it will generally emit bursts of high-frequency vibration or will cause the cones to lockup. Either of these occurrences will cause an abrupt and unpredictable change in the pattern of vibrations produced by the bit. If the prediction error of an adaptive filter that is being used to predict bit vibration is monitored, momentary increases ("spikes") in the prediction error will be observed. These observations can be used to detect roller cone bit failure.

One of ordinary skill in the art, who was aware of the teaching of Randall's use of an adaptive filter to filter noise and improve the quality of a signal, would not have been motivated to use an adaptive filter to "analyze"

the data from the drill string in the way described in the present application. Noise filtering is not analysis. In fact, filtering of noise, as taught in Randall, could eliminate or reduce the very spikes in signal that the presently claimed invention monitors in order to detect bit failure. Hence, the teaching of noise reduction specifically teaches away from the invention claimed in claim 18.

For the above reasons, it is respectfully submitted that all claims are now distinguished from the cited references and in condition for allowance. Favorable reconsideration of the claims is respectfully requested.

Conclusion

Thus, all grounds of rejection and/or objection are traversed or accommodated, and favorable reconsideration and allowance are respectfully requested. The Examiner is requested to telephone the undersigned attorney or Robert Groover for an interview to resolve any remaining issues.

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Respectfully submitted,

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